

# Locally Equivalent Weights for Bayesian MrP

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But the high level idea can be extended much more widely:

1. Assume your initial model was accurate
2. Select some perturbation your model should be able to capture
3. Use local sensitivity to detect whether the change is what you expect
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**Checks of this form can recover generalized versions of many standard diagnostics for linear models.**

## Regression bias:

$$y = \theta^T \mathbf{x} + \varepsilon$$

$$\tilde{y} = (\theta + \delta)^T \mathbf{x} + \varepsilon$$

$$\hat{\theta}(y) = \hat{\theta}(\tilde{y}) + \delta$$

## Regression residual exogeneity:

$$\tilde{y} = y + \varepsilon z$$

$$\hat{\theta}(y) = \hat{\theta}(\tilde{y})$$

## Regression fisher information:

$$\mathcal{I} := \text{Fisher information}$$

$$\Sigma := \text{Score covariance}$$

$$\mathcal{I}^{-1} = \Sigma$$

## General models “bias check”

$$y = f(\mathbf{x}, \varepsilon, \theta)$$

$$\tilde{y} = f(\mathbf{x}, \varepsilon, \theta + \delta)$$

$$\hat{\theta}(y) \stackrel{\text{check}}{=} \hat{\theta}(\tilde{y}) + \delta$$

## General models “exogeneity check”:

$$y \sim \mathcal{P}(y|\mathbf{x}) \text{ and } \mathcal{P}(\mathbf{x}) = w$$

$$\tilde{w} = w + \delta$$

$$\hat{\theta}(\tilde{w}) \stackrel{\text{check}}{=} \hat{\theta}(w)$$

## General models “information check”:

$$y \sim \mathcal{P}(y|\theta)$$

$$\tilde{y} \sim \text{Importance sample using } \tilde{w} \text{ where}$$

$$\tilde{w} = \frac{\mathcal{P}(y|\hat{\theta} + \delta)}{\mathcal{P}(y|\hat{\theta})}$$

$$\hat{\theta}(\tilde{w}) \stackrel{\text{check}}{=} \hat{\theta}(1) + \delta$$

Student contributions and ongoing work:

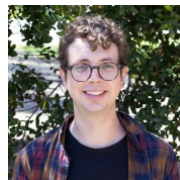
- **Vladimir Palmin** is working on extending MrPlew to `lme4`
- **Sequoia Andrade** is working on generalizing to other local sensitivity checks
- **Lucas Schwengber** is working on novel flow-based techniques for local sensitivity
- **(Currently recruiting!)** Doubly-robust Bayesian Hierarchical MrP



Vladimir Palmin



Sequoia Andrade



Lucas Schwengber

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**Preprint and R package (hopefully) coming soon!**

